# American Fisheries Society

*Western Division*

October 16, 2000

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Dear Ms. Krasnow:

Attached are Western Division of the American Fisheries Society (WDAFS) comments on the Draft Biological Opinion (BiOp) entitled "Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project", dated July 27, 2000.

These comments were prepared according to our by-laws that provide for commenting on regionally important fisheries issues relevant to Division members. The Idaho and Oregon Chapters, as well as the WDAFS have previously passed resolutions supporting the position that the likelihood of Snake River salmon recovery is greater if the four lower Snake River dams are breached.

The Idaho and Oregon Chapters constitute nearly a quarter of the WDAFS membership which is now some 3,300 strong. The general consensus embodied in WDAFS and Chapter resolutions reflects a collective body of scientific and managerial intimacy with Columbia Basin fisheries issues that is arguably unparalleled. The interest and relevance of these issues to WDAFS members is undeniable and provides a compelling rationale for WDAFS comments on the BIO il

Several steps were Iken to ensure that comments were science-based, meaningful, and consistent with **WDAFS** by-laws. Our Policy Review Committee provided oversight of the commenting process and deemed it appropriate given the short time available. The Environmental Concerns Committee solicited reviewers from names provided by WDAFS and Chapter officers and provided overall coordination with Division officers. And finally, all Chapter Presidents were provided an opportunity to review the comments; with most providing editorial comments, but none voicing strong objection to their release.

It would be disingenuous to imply that these comments represent all possible views or perspectives among VVDAFS members regarding the BiOp. However, they were provided by AFS members who are extremely well versed with Columbia Basin fisheries issues and who all possess very high levels of technical expertise. I am satisfied they have provided legitimate,

technically sound, scientifically based comments on the Draft BiOp and ask that they be given due consideration.

It is my understanding that NNIFS is not obligated to accept comments from AFS or other non-governmental organizations, and on behalf of the Western Division of the American Fisheries Society, I thank you for doing so. Please be assured, these comments are offered in a positive spirit and intended solely to contribute towards recovery of Columbia Basin salmon and steelhead; a shared goal I am sure.

Sincerely,

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Cc. Mr. **William W. Stelle Jr, Regional Administrator,** NMFS
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Mr. Donald Sampson, Director, Columbia River Intertribal Fish Commission

Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project

Comments on the Draft Biological Opinion
Submitted by

Western Division of the American Fisheries Society
October 16, 2000

The Draft BiOp issued July 27, 2000 describes the risk from the proposed action (current federal hydropower operations) to the Evolutionarily Significant Units (ESUs) that have been listed under the Endangered Species Act (ESA) in the Columbia River Basin. The proposed action was deemed by National Marine Fisheries Service (NMFS) to pose jeopardy. A Reasonable and Prudent Alternative (RPA) was presented which NMFS deemed to pose no jeopardy in conjunction with off-site mitigation described in the Draft Basin-Wide Salmon Recovery Strategy (All-H Paper). The RPA included the Performance Measures and Standards, which would be used to evaluate the success of the RPA in meeting survival and recovery standards at checkpoints of 5 and 8 years. The Draft BiOp also evaluated effects from an alternative management action, breaching of the lower Snake River hydroprojects.

These comments address the above elements of the Draft BiOp with the focus on Snake River ESUs given their earlier consideration in previous Biological Opinions and subsequent evaluations of their status and recovery actions. The NMFS has spent a great deal of effort in evaluating stock status since the 1995 BiOp. Some of these evaluations are reasonable, insightful and take advantage of recent empirical information. However, the interpretation and use of these evaluations in the Draft BiOp does not adequately address or is not convincing as to the proposed long-term management of the Federal Columbia River Power System (FCRPS) and offsite mitigation as a means to recover threatened and endangered stocks.

Until recently, management actions for Snake River salmon and steelhead stocks have focused largely on technological solutions aimed at improving the survival of juvenile and adult fish around the hydroelectric dams during their migration to and from the Pacific Ocean (ISG 1999; Nemeth and Kiefer 1999). These technological approaches have included, but are not limited to, attempts to transport juvenile fish around the dams, bypass fish that are allowed to migrate in-river around each dam, spill the fish over the dam, and to develop "fish friendly" turbines. Although these techniques have improved the direct survival of fish around or through the dams over the years, the Snake River stocks have continued to decline. Because of this continued decline, in combination with the results from research and modeling, many fishery scientists have concluded there is no feasible technological solution that will recover Snake River salmon and steelhead. Alternatively, there are indications that a more normative and free-flowing river ecosystem is required to facilitate salmon recovery (Marmorek and Peters 1998; *Fisheries* 1999; ISG 1999; Nemeth and Kiefer 1999).

In response to current information, and as part of the efforts to mitigate for hydrosystem impacts on endangered stocks, the breaching of four lower dams on the Snake River has been proposed.

This management action was evaluated through a comprehensive modeling project (PATH – Plan for Analyzing and Testing Hypotheses) performed by a forum of biologists, statisticians, and mathematicians assembled to represent the region with different areas of expertise required for modeling highly mobile organisms in an ecologically and politically complex ecosystem. The PATH forum completed a detailed biological decision analysis to evaluate the different management options recommended for the recovery of Snake River ESUs (Marmorek and Peters 1998). In addition, the NMFS, which is responsible for the protection of anadromous salmon and steelhead under the Endangered Species Act, has addressed the question of dam breach, in the context of improvements in other areas and life stages in the Draft BiOp, using a series of extinction and life history models through their Cumulative Risk Initiative (CRI). While considerable differences exist between the two modeling approaches and their relative results, both approaches indicate that actions that include dam breach are the most effective options for increasing the survival of endangered and threatened Snake River stocks.

Objective risk assessment is critical to ESA decision-making processes but ecological and scientific uncertainty is a given. The key to objective risk assessment is determining how best to meet the biological needs of the fish in the face of these uncertainties. The primary problem with the NMTS Draft BiOp is that it fails to pass the test of being an objective risk assessment on a number of counts. First, a formal risk assessment approach (PATH) that evaluated management alternatives for the hydrosystem over a range of hypotheses for key uncertainties influencing population survival, was abandoned. The PATH assessment determined which management alternatives were most robust, i.e., had the highest probability of meeting recovery criteria over AM range of uncertainties about past stock performance, management effectiveness, and future climate conditions. Instead, NMFS used an approach, that selected a series of favored hypotheses and deterministically estimated which management alternatives met survival and recovery criteria.

In order to determine the relative effectiveness of options for operating and configuring the FCRPS there are a few key uncertainties about how survival is distributed over the salmon life-cycle that strongly influence the results for salmon recovery. The uncertainties that most influence the outcomes of Snake River stocks for both the PATH and CRI analyses are: 1) whether the stress of migrating through the hydrosystem affects survival in later life stages; and 2) the survival (to returning adult) of fish transported around the hydrosystem relative to those that migrate through the hydrosystem (Marmorek and Peters 1998; STUFA 2000). The most influential remaining uncertainty relates to the source of mortality that Snake River fish experience while in the estuary and early ocean. Sources of estuary and early ocean mortality include not only elements of the natural ocean environment, but also delayed effects of earlier life-stage experiences. Although this mortality occurs in the estuary and early ocean, it may be related to a fish's earlier experience through the hydrosystem. Because this mortality may be caused by the cumulative stresses of the hydrosystem during downstream migration as juveniles, a portion of the mortality that occurs in this life stage is called delayed mortality. Evidence from the literature demonstrates numerous mechanisms that would explain this delayed mortality in relation to a fish's experience through the hydrosystem. Spawner and recruit data demonstrate that there is a portion of delayed mortality specific to Snake River stocks that is coincident with the completion of the hydrosystem and greater for upriver stocks relative to similar downstream stocks. And based on recent tagging data, there is direct evidence of delayed mortality by route of passage through the hydrosystem. It thus appears that NMFS did not use an objective risk assessment for Snake River stocks to evaluate the key influential uncertainty of delayed

hydrosystem mortality (or for other uncertainties about the distribution of survival over the salmon life-cycle).

The second major problem area for the NMFS assessment approach to the Draft BiOp is that it focuses on sets of optimistic assumptions when evaluating the RPA. One of the major problems is that the Draft BiOp relies on hypothetical numeric experiments to determine if the RPA will avoid jeopardizing the existence of the Snake River populations. Further, the RPA's off-site mitigation actions proposed to offset hydrosystem impacts are vague and the feasibility of the benefits is not explicitly evaluated. The following comments highlight our major concerns:

**1) The Draft BiOp does not explain why previous analytical efforts were abandoned, particularly the PATH forum for evaluating management alternatives for future configuration of the FCRPS aimed at recovery of Snake River** ESUs.

- It appears the Cumulative Risk Initiative (CRT) abandoned a formal decision analysis approach to describe the risk and probabilities of survival and recovery under alternative management actions. The abandoned PATH approach included extensive internal and external peer review in order to ensure a defensible scientific assessment, which was not designed to be consensus science, but rather to evaluate the range of scientific interpretation and the supporting evidence.
- NMFS reasoning for adopting the CRT approach was to address other ESUs and evaluate impacts of other H's (habitat, hatcheries and harvest) in addition to hydropower options, However, CRT did not explicitly address other H's through a feasibility analysis, but instead through numeric experiments, which relied on hypothetical mortality reductions without empirical justification.
- Evaluations of effects of the RPA and alternative actions as used in the Draft BiOp were not conducted in a collaborative forum with regional experts from other federal, state and tribal salmon management agencies.

2)**Methodology for estimating annual population growth rate (X) employed by CRI appears to be optimistic for current conditions.**

- While population growth rate is critical, other important life history characteristics (genetic diversity, life history diversity and geographic distribution) are not captured in X. It appears that NNIFS recognizes this shortcoming (p. 9-8) and intends to address this in recovery planning. Incorporating this other information will likely result in a more pessimistic description of these stocks than in the Draft BiOp.
- X assumes linear decline in population; however X's from 1980 to present do not appear linear, which underestimates the probability of extinction (Oosterhout 2000).
- Because the Draft BiOp evaluates the 1980-present time period the major decline in stocks is not included in the analysis.
- The base period should describe the total impacts of the Snake River FCRPS, includinglarge impacts created while the hydrosystern was in a state of flux, as this eroded away a healthy population and has large implications to their current status.
- The approach of evaluating extinction is basically dependent on the slope of the decline in a population. The slope (population growth) of a time series that includes a high initial population declining to a small current population will be more negative

than if the population is evaluated after the high initial population has been lost (as in 1980-present). The 1980-present time series provides the most optimistic time series to evaluate for probability of extinction and describing what is required to mitigate for hydrosystem impacts.

- CRI evaluated an alternative time series (1990-1999) and found this time series to be much more pessimistic in estimating the probability of extinction and the necessary improvement to avoid extinction. The same result would occur if evaluating 1970-present.

- The Draft BiOp also considers including future returns based on recent jack returns'and average spawner numbers, effectively raising spawner numbers at the end of the time series and lowering the estimated probability of extinction. Projections should not be considered part of the base period.

3) **Extinction risk and recovery criteria (thresholds, time-frames and probabilities) used in the Draft BiOp are optimistic in evaluating current risk to ESA fisted stocks.**

- Because absolute extinction is modeled as more than one adult return in five consecutive years (maximum life span) in the Draft BiOp, the risk of extinction is likely greatly underestimated because populations may be effectively extinct at this level. NMFS considers risk to be high if absolute extinction probability is greater than 5% in 24 and 100 yrs.
- NMFS is aware that extinction may effectively take place at more than one fish per generation (extinction vortex) and has explicitly argued for larger extinction thresholds in developing a framework to address the minimum Viable Salmonid Population (McElhaney et al. 2000).
- NMFS mischaracterizes reviews of the survival and recovery thresholds determined by the Biological Requirements Work Group (BRWG) as reasons to dismiss thresholds already developed for spring/summer and fall chinook. These criticisms were concerned that the thresholds or standards were not restrictive enough, yet NMFS has moved to least restrictive threshold and standard possible.
- CRI used this extinction metric because of the common interpretation across populations it provides. Alternatives, also evaluated by CRT, that would provide a common interpretation are: accepting risk is high if greater than a I% probability to absolute extinction; the probability of quasi-extinction (I fish returning in a year); and the probabilities to 50% or 90% decline in the population over 24 years and 100 years. These metrics would provide higher estimates of the probability of extinction but were not used in the Draft BiOp to capture risk.
- Probability of extinction is highly dependent on the rate of decline in population growth rate and thus suffers from problems defined in point 2.
- Population growth rate (X) is highly dependent on time series evaluated and thus the probability of extinction and X suffer the problems of point 2.
- By incorporating a 100-year recovery standard, NMFS relaxed the recovery criteria from that established in the 1995 BiOp (48-year).
- The CRI approach does not lend itself well to evaluating recovery, because it assumes that populations continue to grow exponentially at all spawner levels. This

assumption may be reasonable at small population sizes but as numbers approach recovery levels, modeled populations will increase at rates beyond what is reasonable. The effect is to overestimate cur-rent recovery probabilities.

- Assuming density dependence, underlying productivity at recovery levels would be only 60% of current productivity (using the 1980-1994 average spawners) based on the same spawner and recruit information (Schaller et al. 1999; Table 2 coefficients).

4) **Survival improvements needed to avoid extinction and achieve recovery are underestimated.**

Because of the problems estimating extinction described in 3, the cur-rent probability of extinction is underestimated, and thus the needed improvement to prevent extinction is too small.

Because of the problems addressing recovery described in 3, the current probability of recovery is highly optimistic, and thus the needed improvement to achieve recovery is underestimated.

The CRI evaluated a range of hatchery effectiveness. Low hatchery effectiveness is a more optimistic assumption of the wild stock. This low effectiveness was chosen as more likely; however, no evidence is cited in support. Information suggests that hatchery fish that spawn in the wild for SR spring/summer chinook may be as effective or nearly as effective as wild spawners, and thus high end of the range (e.g., 80% hatch effectiveness) should be used by NMFS.

The Draft BiOp suggests that only a 30% improvement in life-cycle survival is needed for all SR spring/summer chinook populations to avoid 5% probability of extinction in 24 years. The CRI appears to have grossly underestimated survival improvements needed to ensure survival of the populations, compared to the >740% increase needed to ensure 24 year survival standard established in the 1995 BiOp (Peters and Marmorek 2000). PATH also estimated that smolt-to-adult return rates (SARs) of 2-6% are needed to ensure survival and recovery. Recent SARs average around 0.7 1 % (STUFA 2000) suggesting that a 280%-850% increase in survival is needed.

**5) The Draft BiOp is not an objective risk assessment because of inequitable treatment of alternative management actions.**

**5.a. Reasonable and Prudent Alternative - Effectiveness of the RPA is optimistic, and uncertainty about off-site mitigation effectiveness is downplayed.**

- The amount of survival improvement gained from "aggressive hydro actions" (RPA) is overestimated because the Draft BiOp assumes for the RPA:
    a) that 1995 BiOp hydrosystem measures can be implemented when in fact since the 1995 BiOp flow and spill levels have rarely been met. The majority of flow targets that were met were involuntary because of the well above average runoff. The year 2000 was an average flow year, and flow and spill targets could not be met;
    b) no delayed hydrosystem mortality of in-river fish, when there is direct evidence that it exists and indirect evidence that it is substantial. NMFS ignored the PATH weight of evidence, which indicated little support for an assumption of no delayed hydrosystern mortality (Marmorek and Peters 1998).

NMFS did not independently evaluate the evidence for this influential assumption; we call on NWS to invoke a weight of evidence procedure (similar to that used in the PATH process) for delayed hydrosystem mortality using independent scientists from the Scientific Review Panel of PATH and the Independent Scientific Advisory Board (of the Northwest Power Planning Council). Using the outcome of this weight of evidence, NWS should reevaluate the effectiveness of the RPA and Snake River dam breaching.

c) a 20% juvenile survival improvement for spring/summer chinook due to current hydrosystem, operations, which is determined by comparing the base conditions as estimated by using PATH passage models (both of which are flow dependent) to the RPA conditions using the NMFS' SIMPASS passage model (which is not flow dependent). The estimated improvement may be simply the result of differences in the models used, or due to the high flow years used to develop SIMPASS (5 out of the 6 years used in SIMPASS are high flow years). But the Draft BiOp attributes this 20% increase to the hydrosystern improvements that will be realized forever;
d) an arbitrary 25% decrease in adult losses in the hydrosystem (7% relative survival improvement) without a specific action, data or analyses to support the benefit (p. 9-148).

- NMFS recognizes off-site mitigation is needed in addition to RPA hydrosystern actions to improve life cycle survival enough to avoid jeopardy (section 9.1.3, p. 9-2).
- Mitigation benefits are simply determined by the remaining survival improvement needed after implementing the RPA. The Draft BiOp assumes that this remaining mortality can be resolved with off-site mitigation. Off-site mitigation benefits are not supported by data or analyses, and appear arbitrary.
- The risk involved in the ability of these off-site mitigation actions to avoid extinction cannot be assessed because the Draft BiOp only assessed the low end of the range of needed survival improvements without attempting to address uncertainty. The high end of the needed survival improvement range was arbitrarily dismissed because NMFS considered it too uncertain.
- The conclusion that *"suggest that the greatest opportunity for survival improvements may lie outside the scope of the hydropower corridor, and hinge on efforts to restore health to the tributaries and estuary where these populations spawn and rear'* (All-H Paper) is based on numeric experiments conducted by CRI. This conclusion is not based on feasible improvements in analyzing the impact from these mitigation measures, but on the fact that a large portion of mortality takes place at this life-stage. However, the amount of mortality at this life-stage is irrelevant, if it is due largely to natural causes. The question should focus on how much survival improvement can feasibly occur at this life-stage from management actions.
- The conclusion is also inconsistent with the PATH findings (Marmorek et al. 1996) that declines in survival rate for Snake River spring/summer Chinook since the 1960s were primarily in the smolt to adult stage (hydropower and ocean), not in the egg-to-smolt stage (freshwater spawning/rearing habitat).
- Off-Site mitigation measures proposed in the BiOp and All-H Paper for spring/summer Chinook have the following shortcomings (generally also apply to steelhead):

a) All-H paper identifies highest priority subbasins for FY2001 restoration; none were Snake River ESUs;
b) one criterion for selecting high priority subbasins included location below the four lower Snake River dams, with a strong likelihood that they will have sufficient adult escapement for optimum utilization of restored habitat (p. 13 All-H paper);
c) lower priority subbasins in Snake River do not include the spring/summer Chinook index populations (which were used to determine risk and needed survival improvements) because habitat quality on Federal land in Snake River considered to be in generally good condition (p. 17 all-H paper);
d) there is room for improvements in non-indicator stocks, but if risk analyses were conducted on these stocks, extinction probabilities or required survival improvements may be much greater;
e) indicator stocks include some in wilderness and high quality habitats, as well as some degraded (decline was similar among good and bad habitats);
f) specific actions not yet identified, only planning and process;
g) time-frame and level of survival improvements not yet assessed;
h) Draft BiOp (p. 9-190) indicates habitat actions will not produce immediate biological effects; the estimate of extinction risk would be higher if the delay in attainment of biological benefits were included in the analysis;
i) PATH evaluated habitat feasibility for index populations (benefits moderate to low depending on stock and habitat quality) but not included in Draft BiOp.

- Off-site mainstem habitat mitigation for fall chinook provides questionable benefits in impounded areas from listed actions (p. 23 all-H paper).
- Off-site habitat mitigation for sockeye offers little room for physical habitat improvement (other than nutrient addition, which has already been done).
- Mitigation from harvest is not reasonable:
  a) Draft BiOp assumes harvest restrictions are forever. The concept of recoven, rebuild stocks to harvestable levels. In addition, Canada has voluntarily restr harvest rates for last few years but may choose not to in the future;
  b) analyses should incorporate harvest schedules based on wild fish escapement (as done in PATH);
  c) much greater survival improvements are needed to provide for fishable populations;
  d) however, we agree with NMFS that there is not much survival improvement possible for spring/summer chinook through further harvest restriction.
- The effectiveness of hatchery reform is not supported by data or analyses:
  a) Draft BiOp suggests potential changes in hatcheries but cannot conclude how these will affect stocks;
  b) potential improvements through hatchery reform is qualitatively evaluated (Tables pgs. 57-69, All-H Paper), the RPA should not be credited for benefits to survival based solely on monitoring and evaluation activities of hatchery practices;
  c) benefits are highly uncertain, one of the criteria to reject dam breach as recovery action.
- Most of the spring/summer index stocks do not have hatcheries, have generally good habitat and were given low priority in habitat restoration, and have almost no room for survival improvements in harvest. Thus, the Draft BiOp conclusion that the RPA

provides no jeopardy, when the proposed action does pose jeopardy is arbitrary and optimistic. In our estimation, there is virtually no difference in the extent to which the proposed action and the RPA actually reduce the likelihood of avoiding jeopardy, unless the RPA assumes these offsite mitigation measures will provide immediate survival benefits to avoid extinction and recover stocks. However, no substantial actions are proposed for off-site mitigation (for Snake River spring and summer chinook stocks) that would provide immediate survival benefits to avoid extinction and recover stocks. For the few off-site mitigation actions identified for Snake spring and summer chinook stocks no feasibility assessment is performed to identify quantifiable immediate survival benefits.

**5.b. Dam Breach Alternative - Effectiveness of the breach alternative is pessimistic, and uncertainty about effectiveness of restoring natural river conditions is emphasized.**

- The Draft BiOp dismisses dam breaching actions by way of comparison, stating breach affects only 4 out of 12 ESUs. Yet the RPA prioritizes off-site habitat mitigation in basins that would not help the Snake ESUs. The approach to different ESUs is inconsistent. This inconsistency of treatment is, at its core, also contrary to the ESA, which provides equal protection mechanisms for all listed vertebrate species (and their distinct population segments). If ESA consultation is on an action that may affect 12 listed entities, the action is a jeopardy action even if it jeopardizes only I of those stocks. Any suggestion of dismissing any particular alternative action (e.g., dam breaching) because it does not address all 12 distinct populations is thus irrelevant under the law.
- Breaching Snake River dams actually would benefit other ESUs by improving mainstem water quality (temperature, gas concentration).
- The Draft BiOp suggests the effects of dam breaching are too uncertain but:

  a) previously, stocks were healthy but were (accurately) predicted to decline after completion of Snake River hydrosystem. Since completion of dams, harvest is negligible and habitat was protected and improved, yet stocks continued to decline (Marmorek et al. 1996);
  b) the Draft BiOp attributes too much uncertainty to the range of delayed hydrosystem. mortality: no delayed hydrosystem. mortality is a very unreasonable assumption, yet NWS conclusions rely on an assumption of no delayed hydrosystem mortality. NWS white-papers (NMFS 2000a,b,c), PATH weight of evidence (Marmorek and Peters 1998), as well as other empirical information provide ample evidence for the existence of delayed hydrosystem mortality;
  c) CRI has repeatedly concluded actions that include dam breaching are most likely to recover Snake River stocks;
  d) PATH found that dam breaching leads to survival and recovery under pessimistic and optimistic assumption of that action (Marmorek et al. 1998; Peters et al.1999), whereas, status quo and increased transportation option coupled with action in other H's did little to improve SR spring/summer chinook;
  e) PATH found only under the breaching scenarios could SR fall chinook recover under all assumptions (Peters et al. 1999). Only under optimistic assumptions

could other actions recover this ESU. but with a much smaller return relative to breaching;

f) the action that PATH suggested would most benefit Snake River steelhead stocks was dam breaching (Marmorek et al. 1998);
g) PATH suggested that sockeye were only expected to benefit from dam breaching (Marmorek et al. 1998);
h) the Independent Scientific Group's (ISG 1999) Return to the River report concluded that dam breaching was the most likely action to recovery stocks;
i) to date the only analyses to incorporate uncertainty into a decision analysis found no-breach options were much more risky and uncertain in their benefits;
j) uncertainty in off-site action areas of habitat and hatcheries is very high. In fact, apparently too high for CRI to evaluate.

- Analyses should incorporate uncertainty to evaluate risk. CRI describes just the extremes of uncertainty without any means to weigh the assumptions, and thus does not move towards scientific resolution but rather leaves the decision makers with the job of sorting through evidence to determine the support for key scientific assumptions (uncertainties).
- Dam breach recovery analysis also may be optimistic for some of same assumptions as the RPA analysis (CRI use of density independent assumption, deterministic approach) and may require additional actions. CRI and PATH have repeatedly stated that the most risk averse actions would be improvements in other H's *and* dam breaching.

**6. Performance Measures and Standards (PMS) - The BiOp provides tittle information regarding how the effectiveness of management actions will be evaluated. Details are lacking and there is no presentation of an overall strategy, particularly regarding statistical approaches. Specific shortcomings are detailed below.**

- Draft BiOp description of PMS is vague. It appears that NMFS proposes to update estimates of X from 1980 to the most recent years (p. 9-18) in mid-point reviews. This needs to be clarified to determine that NMFS is not proposing to simply estimate X newest years.
- Draft BiOp description of PMS needs to explicitly state all the assumptions that were used **and the alternative** assumptions that were not used to determine what the action agencies are required to mitigate for.
- FCRPS mitigation appears to be responsible only for most optimistic set of assumptions: optimistic hydrosystern mortality; no delayed hydrosystem mortality for in-river fish, low hatchery spawner effectiveness, plus optimistic estimates of mortality needed to avoid extinction and achieve recovery as described above.
- The Draft BiOp does not describe how the PMS is met when environmental variability and measurement error are included; NMFS should propose to be able to reject a null hypothesis of one-tailed test that performance standard is greater than minimum required. At the moment we cannot measure performance accurately (e.g., need approximately 20 million PIT-tagged fish to determine that 'D' is greater than 0.6). Will the mid-point evaluation hide, once again, behind uncertainty?

- We agree the main performance standard should be based on overall life-cycle survival such as X. However, X may not be able to handle expected changes in demographic parameters, and at present cannot accommodate density dependence.
- Must be consistent on methods used to determine the standard pre - and post-RPA.
- Although delayed hydrosystem mortality of in-river fish is the most influential assumption; no studies have been identified in PMS that can resolve this issue.

We congratulate NMFS for including performance standards and action items in the RPA section of the Draft BiOp. However, the large number of these nearly 200 action items makes it difficult to understand how all will be monitored effectively. More specificity through this section is warranted.

To a large extent, however, monitoring these action items may be moot if future actions are dictated by the X of ESUs. It is disconcerting to see such a strong reliance on this population metric which is taken from literature published by the agency completing the BiOp (McClure et al. 2000) but not yet peer-reviewed externally. Many scientists disagree on how viability analysis should be completed. One such disagreement is whether a Bayesian or frequentist approach should be used. It appears McClure et al. (2000) used standard techniques (9.2.2.2 Draft BiOp). However, without a more complete review of McClure et al. (2000), it is difficult to judge whether the decision in 1.3.1.2.1 of the Draft BiOp to use this document and metric of survival is most appropriate.

Assuming McClure et al. (2000) adequately estimate X, it remains unclear on how it will be used in standard 9.4.1.3 of the RPA; is the X value used for evaluating this standard the mean X value, upper confidence interval level, or lower confidence interval level? Additionally, a 95% confidence level may not be the most appropriate choice. Consistent with the intent of the ESA to be conservative in the protection of listed species, it may be more appropriate to increase the likelihood that the true X falls within confidence intervals by using a 99% confidence interval.

Depending on how X is being estimated it is highly unlikely the mean value will be above 1.1for all the listed ESUs in the next five years - especially if hatchery fish spawn successfully. Based on standard 9.4.1.3, this suggests consultation will likely need to be reinitiated. This does not appear justified if the goal is to avoid jeopardy over anything beyond a very short time period.

Based on the information presented in Table 9.2-2 it appears unlikely that improvements in hydropower operations will result in several of these ESU's remaining viable. The evidence presented in this document suggests off-site mitigation may offset these deficiencies, however, off-site habitat restoration and improvements are likely to occur over decades.

It remains unclear how a jeopardy determination was avoided. In Section 9.7 the non-jeopardy determinations appear arbitrary. For example, Section 9.7.2.4.3 states, "Based on this indicator metric, a minimum of an additional 35% improvement in survival would be needed in addition to the effects of the RPA and the continuation of recent low harvest rates." The lack of site-specific recommendations of where this 35% (minimum) improvement would be realized is a shortcoming that reduces the probability this ESU will be recovered.

The BiOp thoroughly evaluates all the factors relevant to the decline of salmon and steelhead in the Columbia River Basin, and the mitigation activities in the plan should certainly improve

survival conditions in the Basin. However, these improvements may not meet the Jeopardy Standard listed in 1.3. 1. 1. For some of the ESU's the information presented in the Draft BiOp suggests not. In addition, there is a high level of uncertainly involved in how mitigation will affect many of the population parameters. Given that most ESU's are only likely to persist under optimistic assumptions with little uncertainty incorporated into the estimates, a determination that the hydropower system jeopardizes the continued existence of several ESU's is a reasonable alternative conclusion.

## Literature Cited


BRWG (Biological Requirements Work Group. 1994. Progress Report: Analytical methods for determining requirements of listed Snake River salmon relative to survival and recovery Idaho et al. v. NMFS et al., October 13, 1994.

*Fisheries.* 1999. 'Western Division: Dam removal resolution passes'. Fisheries 24(10):28.

ISG (Independent Science Group). 1999. Return to the river; Scientific issues in the resolution of salmonid fishes in the Columbia River. Fisheries 24(3):10-18.

Marmorek, D.R., and 21 others. 1996. Plan for Analyzing and Testing Hypotheses (PATH): Final report on retrospective analysis for fiscal year 1996. ESSA Technologies Ltd., Vancouver, B.C.

Marmorek, D.R. and Peters, C. (eds.). 1998. Plan for Analyzing and Testing Hypotheses (PATH): Weight of Evidence Report. ESSA Technologies, Ltd. 1765 West 8 1h Avenue, Suite 300. Vancouver BC, V6J 5C6. 116 pp. + Appendices.

Marmorek, D.R., and C.N. Peters (editors). 1998. Plan for Analyzing and Testing Hypotheses (PATH): Final Report for Fiscal Year 1998. December 16, 1998. Compiled and edited by ESSA Technologies Ltd., Vancouver, B.C., Canada. 263pp.

McClure, M. and 5 others. by 2000. A standardized quantitative analysis of the risks faced salmonids in the Columbia River basin. Draft Report dated April 7, 2000. National Marine Fisheries Service, Northwest Fisheries Science Center, Cumulative Risk Initiative, Seattle, Washington. 125 pp. + appendices.

McElhaney, P., M. Ruckelshaus, M.J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable Salmonid Populations and the recovery of Evolutionarily Significant Units. Draft report dated January 6, 2000. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington. 170 p.

Nemeth, D.J. and R.B. Kiefer. 1999. Snake River spring and summer chinook salmon - the choice for recovery. Fisheries 24(10):16-23.

NMFS 2000a. Salmonid travel time and survival related to flow in the Columbia River Basin. March 2000. NWFSC/NMFS White Paper. National Marine Fisheries Service, 2725 Montlake Boulevard East, Seattle WA 98112. 69 pp.

NMFS 2000b. Summary of research related to transportation of juvenile anadromous salmonids around Snake and Columbia River dams. March 2000. NWFSC/NMFS White Paper. National Marine Fisheries Service, 2725 Montlake Boulevard East, Seattle WA 98112. 3 5&

NMFS 2000c. Passage of juvenile and adult salmonids past Columbia and Snake River dams. March 2000. NWFSC/NMFS White Paper. National Marine Fisheries Service, 2725 Montlake Boulevard East, Seattle WA 98112. 138 pp.

Oosterhout, G.R. 2000. Seven questions about the Cumulative Risk Initiative. Decision Matrix, Inc. PO Box 1127 Eagle Point, OR 97524-1127. Submitted to NMFS for the ESA Record. 15 pp.

Peters, C.N., D.R. Marmorek.and 1. Parnell. 1999. PATH Decision Analysis Report for Snake River Fall Chinook, September 1999. ESSA Technologies, Ltd. 1765 West 8b Avenue, Suite 300. Vancouver BC, V6J 5C6. 332

Peters, C.N. and D.R. Marmorek (comps./eds.). 2000. PATH. Preliminary evaluation of the learning opportunities and biological consequences of monitoring and experimental management actions. Prepared by ESSA Technologies Ltd. Vancouver, B.C. Canada. 150 pp.

Schaller, H.A., C.E. Petrosky, and O.P. Langness. 1999. Contrasting patterns of productivity and survival rates for stream-type chinook salmon (Oncorhynchus tshawytscha) populations of the Snake and Columbia River. Canadian Journal of Fisheries and Aquatic Sciences 56:1031-1045.

STUFA: State, Tribal, and U.S. Fisheries Agencies. 2000. A technical review of the National Marine Fisheries Service Leslie matrix model of Snake River spring and summer chinook populations. Attachment of ODFWa. 2000. Comments of the Oregon Department of Fish and Wildlife On The Draft Lower Snake River Juvenile Salmon Migration Feasibility Report and Environmental Impact Statement, April 28, 2000.